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Tool arrangement for binding an object, in particular a cable harness

In order to bind cable harnesses and other objects, use is made of plastic binders which are tied around the object which is to be bound, the ends of said binders being secured by means of a lock. It is known to do this with largely automatically operating tools which, on their end side, have a mount for a lock and comprise devices guiding the band around the object which is to be bound, and back into the lock (brochure entitled "Automatische Bündel- und Verschlußwerkzeuge [Automatic Bundling and Closure Tools] Auto Tool/Tyton Tool" from Paul Hellermann GmbH, Pinneberg). Since the tool must only be set in operation when a lock is located correctly in the lock mount, it is known to provide the tool with a sensor which establishes the presence of a lock in the lock mount. In another context (EP-B-297 337), it is also known to provide in the tool a sensor which establishes that the free band end has passed into the lock, in order that the operations of tensioning and cutting off the band can then be carried out.

If it is desired to establish both that a lock is present and that the band end has passed in, it would be

necessary, in a development of this prior art, to provide two sensors, of which one checks the presence of the lock and the other checks the presence of the band. This involves high outlay, especially since a large number of different functional parts have to be accommodated in the vicinity of the lock mount. Space is thus tight and parts may interfere with one another. The invention provides a relatively straightforward and operationally reliable solution according to claim 1. Provision is accordingly made for a sensor which is designed for establishing the presence of a lock also to sense the presence of the band. For this purpose, in addition to a first sensing position, which it assumes when there is no lock in the lock mount, and a second sensing position, which is assigned to the presence of a lock, it has a third sensing position, which corresponds to the presence of a band.

If the type of lock is one which contains at least one detent for securing the band end which is to be checked, said detent being deflected out of a rest position in the presence of the band, it is expedient to allow the sensor to interact with the detent.

It would be sufficient here merely for the detent to be sensed, in order to establish both the presence of the lock and the deflection of the detent in the presence of a band. It is more expedient, however, if, in addition to a part which senses the band and/or the detent, the sensor has a part which senses the lock body, because, depending on the lock design, the position of the detent in its rest position in the absence of a

band is not determined as precisely as that of the lock body. For this purpose, the sensor may be of multi-step design, a first step interacting with the detent and a second step interacting with a lock-body part.

The direction of the sensing movement of the sensor expediently coincides approximately with the direction in which the lock is to be introduced into the lock mount. This applies at least in respect of the movement direction in which the sensor moves from the first into the second sensing position. Furthermore, the direction of the sensor movement between its second and its third sensing position should correspond approximately to the direction in which the detent moves during introduction of the band. The arrangement is at its most straightforward when the two directions approximately coincide, the movement direction of the sensor advantageously coinciding with the longitudinal direction of the latter because the guiding device may then be of particularly straightforward design. For reasons of space, this direction expediently runs approximately parallel to the end of the tool.

In order that the sensor can engage in the lock approximately in the direction of the detent movement, a through-passage is expediently provided for it in the lock.

In order for the lock always to be in the same position in the lock mount, a fixing clip is expediently provided, or more than one fixing clip is provided, for the lock in the lock mount.

The invention is explained in more detail hereinbelow with reference to the drawing, which illustrates an advantageous exemplary embodiment and in which:

figs 1 to 3 show a partial section through the lock mount and adjacent parts of the tool at different functional stages, and

fig. 4 shows a side view of the lock in a direction transverse to the illustration in fig. 2.

The parts illustrated belong to a tool as is described in the application which has been filed simultaneously and has the official file reference HELT038PEP. A tool mount 2 is located in the end 1 of the tool and is bounded by rigid housing surfaces 3 and walls 4 located parallel to the plane of the drawing, it being possible for said walls to be provided with a pair of clips 5 in order to secure the lock in the mount. The lock 6 is fed in arrow direction 14 through a lock channel, which opens out in the lock mount at 13.

The lock 6 has a band opening 7 for the passage of a band 8, two detents 9 projecting into said opening. The band-passage opening 7 runs transversely to the end 1 of the tool. The tool contains guiding and advancement devices (not illustrated) which push the band 8, in the direction of the arrow 10, first of all through the lock 6. By virtue of guiding devices (not illustrated), the band is tied, in the manner of the lip 11 indi-

cated, around an object which is to be bound. Its leading end 12 then passes into the lock 6 again in the opposite direction to the arrow direction. In this case, the detent 9 adjacent to the band end 12 is moved out of the rest position (fig. 1) into a deflected position (fig. 2).

To the side of the lock mount 2, parallel to the end 1 of the tool, an elongate sensor 15 is mounted in a longitudinally displaceable manner between guide surfaces 16. Its front end passes into the lock mount 2 under the action of a spring 17. The foremost position of the sensor 15 is determined by a stop 18.

The spring 17 acts on the rear end of the sensor 15 via a lever 20 which is mounted pivotably on the housing at 19 and the end 21 of which is in operative connection with a sensor push rod 22, which is forced against the lever end 21 by a spring 23 and bears a magnet 24. Arranged alongside the sensor push rod 22 are magnetic switches 25, 26 which are actuated by the magnet 24 in dependence on the position of the sensor push rod 22. The magnetic switch 25 responds in the position according to fig. 2, and the magnetic switch 26 responds in the position according to fig. 3. If the sensor 15 is located in the position according to fig. 1, neither of the two switches responds.

The front end of the sensor 15 is designed with two steps 30, 31. In the absence of a lock 6, the two steps 30, 31 are located within the lock mount. When a lock passes in the direction 14 from the lock channel into

the lock mount 2, the lock 6 acts on the step 31 and forces the sensor back into the position according to fig. 2. The sensor push rod 22 thus passes into the position in which the switch 25 responds. In this case, the foremost part of the sensor 15 with the step 30 is not intercepted by the lock because the wall 27 of the latter has, at the relevant location, a cutout 28 through which the step 30 passes. It thus passes into the immediate vicinity of the detent 9 or into contact therewith without this changing its position to any significant extent. Although a cutout 28 is only necessary in the wall 27 of the lock which is directed toward the sensor 15, a corresponding cutout is expediently also located in the opposite wall of the lock, in order that the latter can be inserted into the tool in any desired direction.

When, then, the band end 12 passes into the lock 6, the detent 9 is forced back, in which case, via the step 30, it also forces back the sensor 15, namely into the position illustrated in fig. 3, in which the switch 26 responds.

Once it has passed into the lock 6, the band end 12 should be secured as flush as possible with the rear lock side. This can take place by the advancement of the band being brought to a standstill in dependence on the response of the switch 26. It is more expedient, and more precise, to provide a special stop for this purpose. The stop according to the invention is the blade 35, which is provided for cutting off the other band end 8. For this purpose, the blade 35 projects

into the path of the band end 12 without obstructing the movement of the other band end 8. The use of the blade 35 as the stop merits protection possibly independently of the features of the other claims.

It can be seen in the drawing that the sensor according to the invention may be accommodated alongside the blade 35 and can also act on parts of the lock and/or of the band at the same time as said blade without these parts and the functions thereof interfering with one another. The lever end 21 is offset in relation to the plane of the drawing and to the lever 20, with the result that the lever end 21 can move past the blade 35.